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ABSTRACT

A study was conducted to determine (1) the effect of educational level on knowledge gain about energy conservation, and (2) whether media use is associated with differential gain in knowledge across educational levels. Telephone surveys were completed by 333 single-family homeowners in a northern state, many of whom were retired and living on fixed incomes. One year later, 227 of the original sample were reinterviewed. Public affairs energy knowledge, total energy conservation behaviors, media exposure and use, energy information seeking, conservation attitudes, and educational level were all measured. The results indicated that the more highly educated residents in the community appeared to have gained information about the energy situation and its tradeoffs at a faster rate than the less educated. Neither public affairs energy knowledge nor practical energy knowledge directly affected energy conservation behavior, although it appears that at least practical energy knowledge indirectly facilitated actions to save energy in the home, such as lowering thermostats. None of the media usually relied upon by government agencies, utilities, interest groups, and others to convey energy information to the public appeared to be related to the holding of this practical knowledge. (Tables of data are included.) (HTH)

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MEDIA USE AND ENERGY: A PANEL STUDY OF EDUCATION, KNOWLEDGE, AND CONSERVATION BEHAVIOR

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Information held by the public about energy is often considered an important aspect of the energy conservation problem. Stobaugh and Yergin (1979) observe that "the decentralized character of energy conservation means that decisions to conserve, unlike decisions to produce energy, have to be made by millions and millions of poorly informed people." The relatively little research that does exist regarding the public's knowledge of energy matters indicates that a sizable portion of the public may be uninformed or misinformed about the nation's energy situation as well as about personal energy conservation strategies (Farhar et al., 1979).

There is even less research providing reliable evidence on the relationships among media use and energy knowledge, attitudes, and behavior, despite the large number of public information campaigns conducted by various government agencies, utilities, and other groups; the studies that have been done have met with mixed results (see McLeod et al., 1983). The processes by which such information programs could affect energy conservation behavior is, as Olsen (1981) observes, one of the "critical theoretical questions" still unsolved.

One of the attempts to influence public energy conservation on a wide scale using the mass media was President Carter's three television appearances in 1977, in which he termed the energy problem the "moral equivalent of war." The programs had at best a temporary effect on various public cognitions (Owens and Capel, 1979; Allen and Weber, 1983) and perhaps a transient influence on energy conservation attitudes (Richman, 1979), but apparently no impact on behavior, at least in regard to lowering of home heat thermostat settings in a New York community (Luyben, 1982). More recently, however, Winett et al. (1984) found in a field experiment that a cable television program with a story-line format, showing models in homes similar to the viewer's being socially and monetarily rewarded for specific energy conservation behaviors,

influenced energy conservation behavior of viewers for at least six months. The same information delivered in a "talking head" format had no effects on behavior. In other studies, impacts on behavior have been found when prompts and exhortations to save energy have been given to specific groups under specific circumstances, in particular when consumers are given rapid feedback on the amount of energy they are using or saving (see Shippee, 1980; Stern and Gardner, 1981). Interpersonal communication and influence have also been found to relate to adoption of solar energy equipment (Leonard-Barton, 1980) and clock thermostats (Darley, 1978). Stern and Aronson (1984) suggest that, given the wide variety of actions and circumstances that can surround individual efforts to conserve, information which is more specific to individual circumstances may be selected and learned more readily.

Stern and Gardner (1980) note that the limited research that has been done into the effects of practical or "how to" energy information indicates that such information alone seems to have no effect on conservation behavior. Geller et al. (1982) propose, however, that correct information about energy conservation is probably a necessary condition of interventions designed to promote energy conservation behavior. Although attitudes do not predict conservation behavior consistently (see, for example, Berrenberg, 1981; Geller et al., 1982; Olsen, 1981; Ritchie et al., 1981), and procedures that have been found to change information held and attitudes do not necessarily lead to behavior change in areas outside of energy (see Wicker, 1969), it is reasonable to suggest that the correspondence between energy conservation attitudes and energy conservation behavior may be strengthened if consumers have knowledge about energy conditions and savings in the home.

Knowledge of the national and international energy situation (which will be termed "Public Affairs Energy Knowledge") as well as knowledge related to household energy use and options (which will be termed "Practical Energy Knowledge") might

be affected by level of education. Farhar et al. (1979) note that education repeatedly correlates with higher levels of knowledge about the energy situation and that the major sources of information about energy for the public are the mass media.

In their "Knowledge Gap" model, Tichenor et al. (1970) propose that higher status (better educated) segments of society develop knowledge of public affairs and science news at a faster rate than lower status (less educated) segments as infusion of mass media information about those matters increases. Education, they propose, influences the rate of knowledge gain since it is associated with better information-processing, comprehension, retention, and communication capabilities, higher levels of previously stored knowledge, and increased numbers of relevant social contacts. Research in this tradition has revealed contingencies and met with mixed results (see in particular Donohue et al., 1975; Ettema and Kline, 1977; Gaziano, 1983; Miyo, 1983). Gaziano (1983) notes, among other factors, that time-trend data as compared to cross-sectional tend to show unchanging or narrowing gaps, even when publicity is high, although these findings might be confounded by ceiling effects; the overwhelming evidence in the 58 studies she reviews is a consistent relationship between levels of knowledge and education. Thus, education may be an important factor in gain of Public Affairs and Practical energy knowledge.

In a 1981 study of two communities, McLeod et al. (1983) found that measures of Public Affairs Energy Knowledge correlated positively with social status (measured by summing measures of education and income) in one community (Madison) but not in the other (West Allis). This study, a follow-up based on 1981 and 1982 panel data from West Allis, investigates whether a knowledge differential develops in that community based on educational differences. It further investigates whether media use is associated with differential gain in knowledge

across educational levels. The previous two-community study found no consistent pattern at that one point in time, although it is conceivable that patterns could emerge longitudinally.

At the time of the study, West Allis had undergone difficult winters in 1980-81 and 1981-82 and in 1981 had participated in city-wide infrared diagnoses of heat loss from homes. The nation was still overcoming the 1979 Mideast oil shock. Although "energy" had been news since at least 1973, it is likely (although not empirically analyzed for this study) that media coverage of energy had again intensified.

The energy issue is relatively complex. Thus, energy knowledge gain may require information processing capabilities that are more sophisticated than would be necessary for most other areas of news, and therefore may be more highly dependent on educational level. (See Ettema et al., 1983, for discussion of this point.) Energy also has strong self-interest as well as social-interest overtones (see Genova and Greenberg, 1979). A number of studies have concluded that interests or motivations are stronger predictors of knowledge gain than is education (e.g., Ettema and Kline, 1977; Ettema et al., 1983; Lovrich and Pierce, 1984), even for more complicated information (Genova and Greenberg, 1979). It has been suggested, however, that differences in motivation, interest and education may be alternative conditions for knowledge disparities, and that motivation and interest may be dependent on education (Gaziano, 1983). Interest in energy information may represent a perceived informational deficit (what is known as compared to what is perceived as needed to be known), and may be stronger among lower status/less educated segments who feel more of the energy cost pinch. (This may be especially true for information related to saving energy in the home.) Under these conditions, energy knowledge gain may not appear relative to education.

DERIVATION OF HYPOTHESES

Given higher levels of information processing skills among the better educated, it can be proposed that:

H1: There will be a positive relationship between educational level and gain in Public Affairs Energy Knowledge.

It has been proposed that one effect of education is better-developed information processing capabilities. Therefore, it can be expected that:

H2a: The relationship between Public Affairs Media Use and Public Affairs Energy Knowledge will be stronger among the higher educated than among the less educated.

Since newspaper stories and television programs about energy might be expected to have strong public affairs overtones, it can be expected that:

H2b: The relationship between Newspaper and Television energy information processing and Public Affairs Energy Knowledge will be stronger among the higher educated than among the less educated.

Information processing capabilities associated with education may influence the acquisition of Practical Energy Information too. This may further mean that lower educated persons may experience a deficit in the types of knowledge that directly or indirectly could influence the extent of energy savings in the home. It can be proposed:

H3: There will be a positive relationship between education and Practical Energy Knowledge.

Given more highly developed information processing capabilities among the higher educated, it can also be proposed:

H4: Energy communication variables (energy media use and information seeking) will bear a stronger relationship with Practical Energy Knowledge among the higher educated than among the less educated.

It has been proposed that Practical Energy Knowledge may serve as a contingent condition for correspondence between Energy Conservation Attitudes and Energy Conservation Behavior. Specifically:

H5: There will be a higher correlation between Energy Conservation Attitudes and Total Energy Conservation Behaviors among those with higher levels of Practical Energy Knowledge.

H6: There will be a higher correlation between Energy Conservation Attitudes and Lowered Thermostat Setting among those with higher levels of Practical Energy Knowledge.

While not formally hypothesized, notice will be taken of the relationships among energy conservation informational needs/interests, educational level, and Practical Energy Knowledge.

RESEARCH DESIGN

West Allis, a community of 64,000 population in the Milwaukee Metropolitan Area, was chosen as the research site because the relatively large proportion of working class persons provides some important variance in social status in this suburban community. In addition, many residents are retired and living in older homes. Since retrofitting homes for energy efficiency (e.g., insulating walls and attics, or purchasing a more efficient furnace) can be quite expensive, the impact of the energy problem on persons of low or fixed incomes is particularly important to study. Owners of single family homes were the population of interest since their energy behavior options are not as constrained as, for example, those of apartment renters. Information about energy issues and trends might be considered most relevant to homeowner decision-making.

A panel of 333 single-family homeowners in West Allis completed telephoned interviews beginning in the Fall of 1981. The homeowners were chosen by taking a systematic probability sample of owner-occupied residences listed in the City Directory, augmented by random digit dialing in proportion to West Allis phone exchanges. Respondents were further screened to ensure they lived in West Allis, in single family homes, owned the homes, and were the male or female head of the household.

In the Fall of 1982, 227 (or 68%) of the original panel members were successfully reinterviewed. An additional set of 194 single family homeowners, chosen in the same manner as was the original sample, were added as a control

for sensitization effects in the panel. (The original panel had not been told that they would be reinterviewed a year later.) All 421 1982 interviewees were screened as before to ensure they qualified as respondents. After each wave of interviews, most respondents returned permission forms that had been mailed to them, allowing researchers access to multi-year gas and electric usage data, as well as the results of infrared analysis of heat loss from their homes, conducted by the city. These data will be analyzed as soon as they are provided by the utilities.[1]

Interviewers were graduate students and advanced undergraduates trained as members of communication research courses. The interviews were carried out in October and early November of each year, and were validated by random callbacks.

MEASUREMENT

All control, independent and dependent variables for 1981 and 1982 were standardized prior to further analysis.

Dependent Variables:

Public Affairs Energy Knowledge was measured in both years by a closed-ended test in the questionnaire that included items concerning knowledge of the energy situation and about energy processes and relationships. (Difficulty and discrimination indices are indicated for relevant years after each item; correct answers are underlined.) The 1981 Public Affairs Energy Knowledge items (McLeod et al., 1983) were:

> What nation produces the most oil annually? The U.S., Saudi Arabia, Iran, or the Soviet Union? ('81:.04,.05)
>
> By 1990, the average cost of fuel in Wisconsin is expected to remain the same, increase by 50%, double, or triple? ('81:.14,.17)
>
> How much of Wisconsin's electric energy comes from nuclear power? Less than 1%, about 10%, about 35%, or about 75%? ('81:.22,.29) ('82:.28,.33)
>
> Would the deregulation of natural gas raise natural gas prices, lower them, or have no effect on them? ('81:.75,.57) ('82:.78,.42)
>
> Is this statement true or false? If crude oil were not available, there would be no way to manufacture many of our present plastics, synthetic fibers, chemical and other products. ('81:.36,.85) ('82:.36,.33)

True or false? At current rates, within 20 years so much of the nation's natural gas will be used up that there won't be enough to heat the homes now using gas. ('81:.64,.79) ('82:.36,.33)

In 1982, the first and second questions were dropped and the following items were added: (based on the results of further pretesting):

Since 1979, has the per capita consumption of energy in the United States increased, decreased, or remained the same? ('82:.31,.25)

Which mode of transportation uses the largest share of energy used for transportation? Overall, would you say: railroads, airlines, freight-hauling trucks, or private autos? ('82:.51,.79)

Overall, which fuel provides the largest share of the energy we use in the United States? Would you say coal, natural gas, oil, or nuclear power? ('82:.30,.41)

True or false? The earth constantly replaces the reserves of oil, coal, and natural gas as we use them up? ('82:.54,.54)

Practical Energy Knowledge was measured in 1982 only with the following questions regarding energy use in the home:

Which uses more energy? One 100-watt lightbulb or two 60-watt lightbulbs? ('82:.58,.63)

True or false? Leaving a light turned on for a few hours actually uses less energy than repeatedly turning it on and off during that time. ('82:.44,.71)

Caulking and weatherstripping can save how much money in fuel bills? Would you say 2%, 10%, 25%, or 40%? ('82:.51,.71)

Which of the following gives the best payback--that is, which of these comes closest to paying for itself within a year in terms of savings on utility bills? Would you say insulating the walls, insulating the attic, replacing an old furnace, or plugging air leaks by caulking and weatherstripping? ('82:.26,.44)

A dichotomous version of the Practical Energy Knowledge variable was produced by separating high scorers from low scorers in as even a split as was possible, resulting in approximately a 60% high scorers/40% low scorers (0-1 correct) split.

As another measure of respondents' knowledge of the public affairs energy picture, especially of relationships, respondents in 1982 only were asked, prior to the closed-ended energy knowledge test, the following question:

> Some people say that issues are related to other issues. For example, some people say the crime problem might be related to law enforcement, poverty, and other concerns. What about the energy problem? What other issues, if any, come to your mind as related to the energy problem?

The number of relationships respondents named (e.g., related to inflation, environment, international relations, etc.) was recorded. Most respondents (71%) named at least one related issue, with seven related issues the maximum recorded.

Autocorrelation for the Public Affairs Energy Knowledge test is $r=.29$ ($p<.001$). The open-ended test of energy-issue relationships correlates $r=.16$ ($p<.001$) with the Public Affairs Energy Knowledge test, and $r=.01$ (ns) with the Practical Energy Knowledge test.

Energy conservation behavior (see McLeod et al., 1983) was assessed in both years by the following measures:

Total Energy Conservation Behaviors were measured by counting the actions reported in response to the question: "You have probably heard about things people can do to save energy in their homes. Not everyone can or wants to do these things. Can you recall anything you have done in the past five years to save energy in the home, and about when it was done or when you began doing it?" (Panelists reinterviewed in 1982 were asked to report actions taken just in the past year, and the number was added to the previous year's total; respondents added in 1982 were asked to recall activities up to six years previous.)

Thermostat Setting was measured by asking respondents the temperature at which their home heating thermostats are usually set in winter during the day (degrees x .5), while sleeping (x .33) and during the evening otherwise (x .17). Weighted temperatures combined into a single measure and the values reversed for analysis so that higher values represent lower average daily thermostat settings.

Independent Variables[2]:

MEDIA EXPOSURE. Newspaper exposure is the sum of standardized scores measuring the number of days a week the respondent reads a newspaper and the amount of time spent reading a newspaper, for both years. Television exposure, similarly, is the sum of standardized scores measuring the number of evenings a week the respondent watches television and the number of hours spent watching after 5 p.m., for both years. Weekly newspaper usage was also measured each year by asking respondents the number of weekly or neighborhood newspapers they read regularly.

PUBLIC AFFAIRS MEDIA USE. Newspaper public affairs usage was measured in each year by the sum of standardized scores measuring the frequency of reading stories about local and state government and politics, stories about national government and politics, and reading of editorials. Television public affairs usage was measured in each year by the sum of standardized scores measuring the frequency of viewing national news programs, local and state news shows, and news specials/documentaries. Public affairs magazine usage was also measured each year by asking respondents what news magazines, if any, they read regularly. Respondents were also asked how much they rely on family and friends for information about current events.

ENERGY MEDIA USAGE. Exposure to utility pamphlets was assessed in both years by a question measuring the frequency that respondents read the brochures and pamphlets that come as gas and electric bill inserts. Exposure to energy commercials was measured both years by a question asking respondents whether they have seen any commercials recently about energy conservation practices. Processing of newspaper energy information was measured as the sum of standardized scores of questions determing the likelihood that the respondent would read a newspaper article on energy if he or she comes across it, and the likelihood

that the respondent would "stop and think about ideas in the article" after reading. Processing of television energy information was assessed by summing the standardized scores of questions determining the likelihood that the respondent would watch a program about energy, and the likelihood that the respondent would "stop and think about the ideas in that program" after viewing. Interpersonal communication about energy was assessed by asking respondents how frequently they discuss energy use in the home with persons who are not a part of the household.

ENERGY INFORMATION SEEKING. Information-seeking about energy was specifically measured by asking respondents if they had recently requested information about energy saving in the home, whether they have had a home energy audit by a utility, and whether they have sought the results of the infrared analysis done of each home in the city, which requires a trip to city hall and a nominal fee. (The infrared question was added in 1982.)

ENERGY INFORMATION INTERESTS. Interest in various types of energy-use information was measured first in 1982 by asking how interested the respondents would be in each of the following types of information: what others are doing to save energy in homes like theirs; how much money energy conservation measures save; how much energy they are using as compared to other homes like theirs; and how much energy they are using as compared to a year earlier. Respondents in both years were asked if they believed they needed more information about saving energy in the home.

SALIENCE AND ATTITUDES. Energy Salience was based on the importance ascribed energy as an issue by the respondent. Energy Conservation Attitudes were measured by summing the ratings on five-point Likert scales for five items (see McLeod et al., 1983):

> To me, it's worth the extra expense to keep the thermostat above 65 degrees. (Reverse scored.)

It is everyone's responsibility to conserve energy: the little things add up.

People who can afford it should be able to buy as much energy as they want. (Reverse scored.)

In my daily life, there is more to be gained than lost by cutting down on the use of energy.

I know science will find an answer before energy problems get too bad. (Reverse scored.)

Based on further testing of the attitude items, the first item was replaced in 1982 by the following (see Becker et al., 1981):

I am willing to wear heavier clothes indoors in the winter so that I can set my thermostat lower than I otherwise would.

The index is scored so that higher values represent pro-conservation attitudes.

Control Variables:

DEMOGRAPHIC. The respondent's age, educational level, income, age of the dwelling unit, and the number of inhabitants (hereafter referred to as "family size") were measured in both 1981 and 1982. These five variables have been found to relate to energy conservation either directly or indirectly in past studies (see Ritchie et al., 1981; McLeod et al., 1983). Education was measured as the number of years of formal schooling completed. The relatively large proportion of respondents with 12 years of schooling (equivalent to high school completion) made an even split of the sample between "high" and "low" education impossible. It was decided to include those with 12 years' education among the less educated, which also produces the closest to an even split even though it results in about a two-thirds lower educated to one-third higher educated split in both years.

SENSITIZATION AND MORTALITY. Respondents in 1981 and 1982 were coded according to whether or not they were lost in 1982 from the 1981 Survey (mortality), and whether they were members of the panel in 1982 or added as members of the 1982 control (sensitization). In both cases, members of the 1981-82 panel were coded as 1, non-members as 0.

STATISTICAL ANALYSIS

One way analyses of variance were used to test for sensitization and mortality differences across the various dependent, independent, and control variables.

Partial correlations, controlling for other demographic control variables, were used to indicate the relationships between educational level and the dependent, independent, and control variables for each year. Sensitization was included as a control variable in 1982.

Hierarchical multiple regression analyses were used to test the relationships of independent variables to Public Affairs Energy Knowledge, Practical Energy Knowledge, Total Energy Conservation Behaviors, and Thermostat Setting. Given the large number of variables, hierarchical regression offers the opportunity to observe any influence of multi-collinearity in the regression as well as representing structure in the analysis (see Cohen and Cohen, 1975). Relevant partials were examined at each stage of the hierarchical regression.

Multiple regressions regarding Public Affairs Energy Knowledge "within years" for 1981 and for 1982 were conducted by entering demographic control variables, followed by salience and conservation attitudes as a block, then media exposure variables, then public affairs media use variables, then energy media use variables. For 1982, sensitization is entered first, prior to the demographic control variables. To assess relationships among variables changing across time in the panel, the 1981 Public Affairs Energy Knowledge variable was entered first, then the block of 1982 levels of demographic control variables, then the 1981 sets of salience/attitude and communication variables in the order noted previously, then the 1982 sets of these variables in order. The displayed partials for 1981-82 represent the association of levels of the control variables with change in the dependent variable across time, and the relationship of change

in the independent variables with change in the dependent variable across time. Although time is involved, the coefficients represent correspondence and not causality (see Cohen and Cohen, 1975). Given the structural characteristics of the demographic control variables, and the fact that little or no variance would be expected across time, they are entered as 1982 levels only in the 1981-82 regression.

Regression regarding the Practical Energy Knowledge variable is conducted for 1982 only, with a fuller array of energy communication, energy information-seeking, and energy information interest variables entered in later blocks. Public Affairs Energy Knowledge is also entered as an independent variable, and the regression is controlled for sensitization as the first variable entered.

Since the regression analyses involve dividing the sample by high or low education and high or low levels of Practical Energy Knowledge, variance of the variables was examined within these subsamples in particular, and no problems of small variances found. Given the large number of variables in the 1981-82 analyses in particular, a proportionately small sample size in the panel, and the possible influence of sensitization on relationships, inferences drawn from the 1981-82 analysis are accepted only if also validated by examination of the relationships among those variables in 1981 and in particular 1982, with the control for sensitization added in the latter.

Direct tests of the influence of the level of Practical Energy Knowledge on attitude/behavior correspondence are conducted with partial correlations between attitudes and the two energy behavior measures separately, for each level ("high" versus "low") of Practical Energy Knowledge. The partials are controlled for sensitization, demographic variables, Salience, and Public Affairs Energy Knowledge. Tests of differences between these and the other partial correlations across subsamples are based on tests of differences between zero-order correlations across groups, with the standard error adjusted for use of partial correlations (see

Hays, 1973, especially pps. 712 and 663-664). Although partial betas are displayed in the multiple regression tables, pairwise tests are performed on the correspondent partial correlation coefficients that emerge before the variable is entered into the equation.

SENSITIZATION AND MORTALITY

Mortality from the 1981 sample appears to relate to only three variables in the analysis: readership of local weekly newspapers, perceived need for energy conservation information, and conservation attitudes. Panelists were slightly more likely to read local weekly newspapers (eta^2=.02, F(1,331)=6.61, p<.01) than were those lost from the 1981 wave. Local papers did not carry any information about the survey, however. Panelists did perceive somewhat more of a need for energy information than those lost (eta^2=.02, F(1,331)=4.88, p<.05), although it is noteworthy that respondents remaining in the panel do not have stronger conservation attitudes than those lost, as might be expected if such attitudes were to influence the likelihood that respondents would co-operate in a second wave of 20-minute interviews. If anything, it appears that those lost may have had somewhat stronger conservation attitudes (eta^2=.01, F(1,325)= 3.90, p<.05).

Sensitization appears to have influenced the number of actions taken to save energy in the home (eta^2=.02, F(1,407)=7.85, p<.01) and Public Affairs Energy Knowledge (see Table 2). It is noteworthy that the sensitization effect is pronounced among the more highly educated (partial beta=.22, p<.05), with no apparent effect among the less educated. Perhaps information processing skills among the higher educated interact with sensitization to promote knowledge gain. There appears to be a slight tendency for panelists to have been sensitized toward getting the results of the infrared analyses, but this effect only approaches statistical significance (p=.058).

RESULTS

EDUCATION WITH CONTROL, INDEPENDENT AND DEPENDENT VARIABLES

Partial correlations of education with control, independent and dependent variables for 1981 and 1982 are shown in Table 1. Partials between education and other demographic control variables are controlled by the remaining demographic control variables; partials between education and independent and dependent variables are controlled by age of the respondent, income, age of the house, and family size. All 1982 correlations with independent and dependent variables are controlled for sensitization.

The relationship of educational level to the other demographic control variables is consistent in both years: the less educated are older, have lower incomes, and live in older homes. There is no relationship between education and the size of the family in either year. Energy issue salience bears no

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Table 1 About Here

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relation to education, and pro-conservation attitudes are weakly related to educational level at very best, with partial correlation of the same magnitude of .10 in both years but significant at .05 in 1982 due to sample size, and approaching significance at .06 in 1981. Past research has found it difficult to find relationships between educational level and energy conservation attitudes (see Farhar et al., 1979), even though environmental concern has been found to correlate positively with educational level in other studies (see Weigel, 1977).

Among the media exposure and public affairs media use variables the only pattern consistent across both waves is a positive relationship between education and reading of public affairs magazines, which could contribute to differential growth in knowledge. While it is possible that there may be shifts away from

television among the more highly educated, but a lessening of differences in newspaper and television public affairs usage, the differences are relatively small and outside of the scope of this analysis.

Only one energy communication variable--the information-seeking measure of having had a utility audit--shows a slight but significant relationship with education in both years ($p<.05$). This finding is consistent with Hirst et al. (1981), who found in a nationwide review that higher status individuals are more likely to request these audits. Energy information needs and interests seem to be distributed evenly across educational levels, however. Thus, it does not appear that the less educated have stronger information needs or interests, at least that they can identify. Changes in the relationship of educational level with interpersonal discussions about energy may be important for further analysis, but are beyond the scope of this study.

The Public Affairs Energy Knowledge variable correlates with education in 1982, but not in 1981. Further analysis will attempt to determine whether gain in this form of knowledge is based on level of education across these two years. The open-ended energy relationships test, and the Practical Energy Knowledge measure, both included in the 1982 wave only, both show statistically significant relationships with education as well.

Neither energy behavior measure, however, correlates with education in either year.[3]

EDUCATION AND KNOWLEDGE GAIN

Given higher levels of information processing skills among the better educated, it has been proposed that:

H1: There will be a positive relationship between educational level and gain in Public Affairs Energy Knowledge.

Table 2 indicates that the change in level of Public Affairs Energy Knowledge 1981-82 is positively associated with educational level over time (partial beta=.33, $p<.01$). With sensitization controlled, the relationship remains in the 1982-only analysis for the entire second-wave sample (partial beta=.18, $p<.01$). Thus the

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Table 2 About Here

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null hypothesis for H1 is rejected, and support given to the proposition that educational level is associated with gain in Public Affairs Energy Knowledge.

It is also apparent from the analysis of demographic control variables in Table 2 that age repeatedly has a negative relationship with Public Affairs Energy Knowledge, significantly among the less educated. The special problems of the aged may bear further investigation in this regard, especially if lower levels of energy knowledge affect their abilities to cope with the energy situation. The relationships between Public Affairs Energy Knowledge and age of the house in 1981 and with age of the house and size of the family in the 1981-82 panel are not reproduced in the 1982 analysis. Similarly, the relationships of salience, attitudes, and newspaper and television exposure to this form of knowledge do not show statistically significant and consistent patterns in the panel and when sensitization is controlled. One exposure variable, use of weekly newspapers, is negatively related to knowledge gain across time among the more highly educated, contrary to expectations. It is possible that the weeklies carried little information, or perhaps even some misinformation, about the wider energy picture, affecting the gain or correctness of knowledge among the higher educated who have become more dependent on that medium.

EDUCATIONAL LEVEL, MEDIA USE
AND KNOWLEDGE GAIN

Given that education may result in stronger information-processing capabilities, it has been hypothesized:

H2a: The relationship between Public Affairs Media Use and Public Affairs Energy Knowledge will be stronger among the higher educated than among the less educated.

H2b: The relationship between Newspaper and Television energy information processing and Public Affairs Energy Knowledge will be stronger among the higher educated than among the less educated.

In regard to H2a, there is no evidence either from significance of partials or from pairwise comparisons that reading newspaper public affairs stories, reading news magazines, or viewing television public affairs programs relates to Public Affairs Energy Knowledge more strongly among the higher educated such that the relationship is maintained over time. There are, in fact, some nonsignificant reversals of the expected pattern across time for newspaper and television public affairs use, and for reliance on interpersonal communication. The significant negative relationship between this form of knowledge and reliance on family and friends for public affairs information among higher educated panel members disappears when sensitization is controlled. Thus, the null for H2a cannot be rejected.

Similarly, there is no evidence that either Newspaper or Television Energy information processing bears stronger relationship to Public Affairs Energy Knowledge among the higher educated. There are, as with Public Affairs Media Use, some non-significant reversals of patterns. The relationships of Television Energy Information Processing (negative) and Energy Commercial Viewing (positive) with 1981-82 gain of this knowledge disappear when sensitization is controlled. Thus, the null for H2b cannot be rejected.

EDUCATIONAL LEVEL AND
PRACTICAL (HOUSEHOLD) ENERGY KNOWLEDGE

Practical Energy Knowledge acquisition might be influenced by processing skills associated with education, such that:

H3: There will be a positive relationship between education and Practical Energy Knowledge.

Table 3 indicates that there is a significant and positive relationship (partial beta=.16, $p<.01$) between education in 1982 and level of Practical Energy Knowledge in 1982. (A set of questions for this form of knowledge, as previously noted, was first added in 1982.) Thus, the null hypothesis is rejected, and support given to the proposition that Practical Energy Knowledge correlates positively with educational level.

It has also been proposed that:

H4: Energy communication variables (energy media use and information seeking) will bear a stronger relationship with Practical Energy Knowledge among the higher educated than among the less educated.

Table 3 indicates that none of the energy communication variables, except for the information-seeking variable of Requesting Energy Information, bear a relationship with Practical Energy Knowledge either in the entire sample or between the two educational levels. A test of the differences between partial correlation coefficients generated prior to entry of this variable into the

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Table 3 About Here

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equation indicates that there is a stronger relationship of this form of information seeking to Practical Energy Knowledge among the more highly educated than among the less educated ($Z=2.50$, $p<.01$). Thus, the null for H4 can be rejected only in regard to the apparent Practical Energy Knowledge increase that may occur when higher educated persons seek specific energy information about saving energy for their homes.

There are no statistically significant relationships between levels of Practical Energy Knowledge and the perceived need for, and interests in, energy information, based on this analysis. Since the higher educated have higher levels of this knowledge, they may not perceive a need. The less educated, who have lower levels of this knowledge, may be unaware of a deficit, and thus not illustrate greater need or interest. It is also noteworthy that, with education and other variables controlled, there is no significant relationship between Public Affairs Energy Knowledge (knowing about the energy problem) and Practical Energy Knowledge (knowing information relevant to doing something about energy use in one's own home).

PRACTICAL KNOWLEDGE, CONSERVATION ATTITUDES, AND ENERGY CONSERVATION BEHAVIOR

It has been proposed that Practical Energy Knowledge may serve as a contingent condition for correspondence between Energy Conservation Attitudes and Energy Conservation Behavior, allowing homeowners to put attitudes into action. Specifically:

H5: There will be a higher correlation between Energy Conservation Attitudes and Total Energy Conservation Behaviors among those with higher levels of Practical Energy Knowledge.

H6: There will be a higher correlation between Energy Conservation Attitudes and lowered Thermostat Setting among those with higher levels of Practical Energy Knowledge.

As Table 4 indicates, there is no significant direct relationship between Practical Energy Knowledge and either the number of behaviors undertaken to conserve energy (partial beta=-.04) or the lowering of the home heat thermostat setting (partial beta=-.01). Conservation Attitudes do, however, correspond to a slight but significant degree with both of these behaviors. Comparing partial correlations between those with low and with high Practical Energy Knowledge, we find that the relationship between Conservation Attitudes and

Total Energy Conservation Behaviors is stronger among those with higher levels of Practical Energy Knowledge ($Z=1.86$, $p<.05$). Similarly, the relationship

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These factors could have more influence on behaviors if the respondent has lower levels of Practical Energy Knowledge.

Analysis of variables related to lowered Thermostat Setting indicates a strong and consistent relationship with age such that older persons are much more likely to keep their homes warmer by keeping the thermostats set higher. Given possible problems with hypothermia, this pattern is certainly understandable. Given the cost of energy and the limited incomes of the elderly, this relationship along with their sources of information about energy are worth further study. It also appears that persons with lower levels of Practical Energy Knowledge living in older houses are more likely to lower their thermostats. The reason is not altogether clear, except that this may be preferred to more expensive or extensive retrofitting that older homes might require and may especially be prohibitive to persons with less Practical Energy Knowledge. Further analysis of this relationship is beyond the scope of this paper. It also appears that thermostat setting and presumably the related cost of energy is not as sensitive to income as it is to some of these other variables.

CONCLUSION

The higher educated in this community appear to have gained information about the energy situation and its tradeoffs at a faster rate than the less educated. Thus, there is some evidence of a "Knowledge Gap" in regard to Public Affairs Energy Information. It is also quite possible that this gap extends to information about the energy situation and its tradeoffs in the home, what has been termed "Practical Energy Knowledge." The relationship between educational level and this form of knowledge, measured in 1982 only, is consistent with the formation of a "gap," although of course no direct evidence of change is presented.

While neither Public Affairs Energy Knowledge nor Practical Energy Knowledge directly affect energy conservation behavior, it appears that at least Practical Energy Knowledge facilitates the performance of actions to save energy in the home, including the lowering of the home heating thermostat setting, among those with attitudes that favor energy conservation more strongly. Given higher levels of Practical Energy Knowledge, homeowners with higher incomes are also more likely to take actions to save energy around the home. Respondents with lower levels of this form of knowledge seem to lower their thermostats if they live in older homes, and report more actions taken in their households to save energy if they live among larger families. It is possible, but not totally clear, that in the former case lack of knowledge of other alternatives for older homes results in this strategy by default. In the latter case, someone besides the respondent may possess Practical Energy Knowledge along with Energy Conservation Attitudes, or the "person-power" exists for do-it-yourself projects, with the result being more actions taken to conserve energy in the household.

The lowering of the home thermostat setting, with its implications for lower utility bills, is not related to income. It seems more sensitive to the factors already noted, and particularly to age. Given the economic situation of the elderly, these relationships can be seen as grist for further study of the way in which the elderly cope with the energy situation.

Given that Practical Energy Knowledge seems to serve indirectly as a facilitator of energy conservation behavior in the circumstances noted above, which communications media seem to be related to this type of knowledge?

Apparently, none of the usual media relied on by government agencies, utilities, interest groups and others to convey energy information to the public seem to relate to holding of this Practical Energy Knowledge. Casual interpersonal channels are similarly unrelated to acquisition of this type of information. It

appears as though those who want or need this information have had to ask for it more directly from utilities, government agencies, and other sources named by the respondents. This information-seeking strategy seems to yield a better payoff in acquisition of Practical Energy Knowledge among the higher educated, perhaps due to better-developed information seeking and processing skills. It is possible that the information sought is specific to circumstances in the homeowner's own dwelling. This finding is consistent with Stern and Aronson (1984), who note that the type of general energy savings information usually presented to the public is inappropriate because of the wide variation in energy use and conservation problems faced by individual consumers; strategies that help save energy in some situations are not right for others, due to differences in fuels used, climate, construction of the home, ages, employment status, local regulations, and control over thermostats. In this highly segmented type of market, they note, "people who accept general energy advice, from whatever source, risk disappointment....Energy users who know this will be appropriately wary of information; those who do not will sometimes be satisfied, but other times they will become disillusioned." This wariness might be exhibited by the information-seeking pattern noted among the more highly educated, with its apparent influence on gain of Practical Energy Knowledge. There may be patterns of information needs unmet in the widespread public information campaigns about energy, which need further assessment.

NOTES

1. The infrared analysis was conducted in the January prior to the first wave of interviews, and will set a baseline for determining insulation needs (e.g., attic, walls, windows) in homes at that time. Gas and electric data run from October 1980 (prior to the infrared analysis, and a year before the first wave of interviews) to April 1984. Infrared and energy usage data will aid validation and interpretation of self-reported conservation behaviors. A third wave of interviews, yet to be analyzed, was conducted in the fall of 1983.

2. General approach to blocking of these variables is based on McLeod et al., 1983. Also from that source are measures of: Media Exposure; Public Affairs Media Use (Newspaper and Television indexes differ somewhat in composition); Energy Media Usage (Newspaper and Television indexes differ in the substitution of the "thinking about" measures for measures of attention paid); having a utility audit; requesting information and needing information about energy saving in the home; Salience; and 1981 measures of Energy Conservation Attitudes.

3. When income was combined with education to form an index of socioeconomic status in 1981, energy conservation behaviors related positively to SES in West Allis and in Madison. Lowering the thermostat was also linearly related to status in Madison. In West Allis, however, the relationship was curvilinear, with the lowest settings among the middle status respondents. See McLeod et al., 1983.

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Table 1: Partial Correlation of Education With Control, Independent, and Dependent Variables For 1981 and 1982

Variable	1981	1982
Age	-.13*	-.12*
Income	.30**	.21***
Age of House	-.17**	-.12*
Family Size	-.05	.03
Salience	.08	-.04
Conservation Attitudes	.10	.10*
Media Exposure:		
Newspaper	.09	.02
Television	.00	-.10*
Weekly Newspapers	.11*	.02
Public Affairs Media Use:		
Newspaper Public Affairs	.19***	.06
Television Public Affairs	.14*	.02
Public Affairs Magazines	.14*	.18***
Interpersonal	-.06	.00
Energy Media Use:		
Utility Pamphlets	.07	-.01
Commercials	.07	-.04
Interpersonal	.14*	-.05
Newspaper Energy Stories	-.02	.07
Television Energy Programs	.05	-.06
Energy Information Seeking:		
Utility Energy Audit	.11*	.10*
Infrared Analysis (1982 only)		-.03
Requested Energy Information	.08	.01
Energy Information Interests:		
Need Energy Information	.06	.08
What Others Do...(1982 only)		.06
How Much Money...Save (1982 only)		.03
Use Comp'd Other Homes (1982 only)		.02
Use Comp'd Last Year (1982 only)		-.03
Knowledge:		
Public Affairs Energy	.05	.18***
Practical Energy (1982 only)		.13**
Relationships (1982 only)		.20***
Behavior:		
Total Energy Conservation Behaviors	.10	.02
Lowered Thermostat Setting	.01	.06
N=	(333)	(421)

Key: * p<.05
** p<.01
*** p<.001

Note: Relationships with independent and dependent variables controlled by demographic control variables, and by sensitization in 1982. Relationships with control variables controlled by remaining control variables.

Table 2: Multiple Regression--Relationships of Control and Independent Variables With Public Affairs Energy Knowledge Across Years (Betas)

	1981			1982			1981-1982		
Variable	Sample	Low Ed.	High Ed.	Sample	Low Ed.	High Ed.	Sample	Low Ed.	High Ed.
Sensitization				.10	-.01	.22*			
Education	.03			.18**			.33**		
Age	-.26**	-.26**	-.33	-.12	-.29**	-.01	-.22*	-.41**	-.21
Income	.04	.07	.01	.16**	.17*	.13	.05	.02	.15
Age of House	.14*	.10	.22	-.05	-.12	.12	.15	.03	.42**
Size of Family	-.09	-.12	-.11	-.08	-.08	-.16	-.15	-.10	-.33*
Salience	-.04	-.04	.03	.04	.01	.14	.21**	.09	.56**
Conservation Attitudes	-.15*	-.11	-.30	-.04	.03	-.16	-.14	-.06	-.20
Media Exposure:									
Newspaper	.04	.01	.10	.01	.08	-.10	-.17	-.02	.00
Television	-.16*	-.22*	-.06	-.04	.00	-.13	.07	.13	-.09
Weekly Newspapers	-.06	-.03	-.08	-.01	.08	-.18*	.01	.01	-.39**
Public Affairs Media Use:									
Newspaper	.09	.09	.20	-.08	-.10	-.03	.11	.07	.04
Television	.10	.15	-.08	.03	.02	-.01	-.06	-.06	.31
P.A. Magazines	.02	-.03	.18	.11	.07	.16	.00	-.08	.12
Interpersonal	-.02	-.05	.08	.05	.05	-.05	-.01	-.07	-.57**
Energy Media Use:									
Utility Pamphlets	.01	.00	.03	-.02	-.11	.08	.00	-.12	.18
Commercials	.06	.06	-.04	-.01	-.05	.06	-.03	-.14	.35**
Interpersonal	.01	.10	-.11	.11*	.11	.12	.10	.19	-.16
Newspaper Energy	-.02	-.05	.04	.14*	.13	.20	.10	.11	-.12
Television Energy	.14	.14	.23	-.01	.01	-.01	-.16	-.11	-.36*
Multiple r:	.34*	.38	.41	.42**	.44**	.51**	.62**	.66**	.85**
N=	(295)	(162)	(83)	(354)	(221)	(133)	(188)	(123)	(65)

Key: * p<.05
** p<.01

Dependent Variable: Public Affairs Energy Knowledge

Table 3: Multiple Regression--Relationships of Control and Independent Variables With Practical Energy Knowledge (1982) (Betas)

Variable	Sample	Low Ed.	High Ed.
Sensitization	.02	.04	.07
Education	.16**		
Age	.07	.00	.16
Income	-.03	-.15	.13
Age of House	.04	.00	.06
Size of Family	.05	.10	.05
Salience	-.04	-.11	.12
Public Affairs Energy Knowledge	.09	.09	.16
Conservation Attitudes	-.07	.02	-.20
Media Exposure:			
Newspaper Exposure	.02	.05	-.14
Television Exposure	-.07	-.06	-.08
Weekly Newspapers	.00	-.05	.11
Public Affairs Media Use:			
Newspaper Public Affairs	-.10	-.06	-.15
Television Public Affairs	-.02	.00	-.06
Public Affairs Magazines	.00	-.06	.12
Interpersonal	-.11	-.13	-.17
Energy Media Use:			
Pamphlets	.01	.00	.04
Energy Commercials	-.02	.00	-.14
Newspaper Energy Stories	-.11	-.14	-.05
Television Energy Programs	.06	.09	.13
Interpersonal	.02	.04	.07
Energy Information Seeking:			
Utility Energy Audit	.00	.01	-.03
Infrared Analysis	-.01	.02	-.03
Requested Energy Information	.13*	.06	.21*
Energy Information Interests:			
Need Energy Information	.08	.02	.14
What Others Do	.09	.05	.09
How Much Money...Save	-.13	-.10	-.22
Use Compared to Other Homes	.00	-.02	.01
Use Compared to Previous Year	.01	.01	.04
Multiple r=	.34	.29	.52
N=	(347)	(216)	(131)

Key: * p<.05
** p<.01

Dependent Variable: Practical Energy Knowledge

Table 4: Influence of Level of Practical Energy Knowledge (PEK) On Attitude/Behavior Correspondence in Energy Conservation 1982

	Dependent: Total Energy Conservation Behaviors			Dependent: Lowered Thermostat Setting		
	Sample	Low PEK	High PEK	Sample	Low PEK	High PEK
Sensitization	.15**	.21*	.11	.05	.11	.00
Education	.00	.03	-.04	.04	.16	-.03
Age	-.07	-.06	-.07	-.32**	-.28**	-.36**
Income	.13*	.00	.24**	.08	.05	.09
Age of House	.02	-.11	.12	.02	.22**	-.12
Size of Family	.19**	.28**	.12	-.08	-.01	-.08
Salience	.02	-.04	.06	.04	.06	.04
Public Affairs Energy Knowledge	.01	.01	.03	-.04	-.02	-.07
Practical Energy Knowledge	-.04			-.01		
Conservation Attitudes	.19**	.14	.24**	.22**	.17	.25**
Multiple r	.39**	.43**	.43**	.40**	.43**	.45**
N	(361)	(140)	(221)	(359)	(139)	(220)

Key: * p<.05
** p<.01